

sional space (S_3), which is determined by any four of its-points which are not coplanar. There is no logical reason why we should not assume the existence of at least one point which does not belong to S_3 ; if we do so, we are able, by similar arguments, to show that there will be a space S_4 , containing S_3 , which is determined by any five of its points which are *independent*; that is to say, which do not belong to the same three-dimensional field.

The important thing to notice here is that the argument is of such a kind that it does not appeal to intuition at all. It is true that by drawing figures, or making models, we can provide images which help us to see that for an S_1 , S_2 , or S_3 our assumptions are not self-contradictory—or rather to give us an irrational conviction that things are so; for, of course, nothing but a formal proof can demonstrate the consistency or inconsistency of a set of formal propositions, such as we are ultimately dealing with here.

When the reader has reached this point, he will see that we can define and investigate a sequence of spaces:—

$$S_1, S_2, S_3, \dots S_n, \dots$$

(each being a field of points) on the assumption that when we have reached a space S_n there is at least one point which does not belong to it. A space S_n is determined by $(n+1)$ independent points; namely, such as do not belong to one and the same S_{n-1} .

The author does not go further than the S_4 . After establishing its (logical) existence, he proceeds to discuss perpendicularity and angles; symmetry, order, and motion; hyper-surfaces and polyhedra; the theory of parallels; and that of volume-measurement. Finally, there is a chapter on the regular "polyhedroids" (hyperpolyhedra) in the S_4 .

There are many interesting details and illustrations; we may refer to one of these, as it shows very well the way in which we are brought to a halt in trying to make actual images of things in the S_4 . If, in an S_2 , we draw a square, then a square on each of its sides, and finally a square on one of the outermost sides (so as to make a Latin cross) we can see how to fold the squares about common edges until they form the faces of a cube in our S_3 . Suppose, now, that in our S_3 we draw a cube; then a cube on each of its faces; and finally a cube on one of the outermost faces of the last. If we could get this solid into an S_4 , we could "fold" the eight cubes about adjacent faces so as to form the boundaries of a hypercube. Until we can "see" how to do this, we have no proper intuition of an S_4 , such as we have of the lower spaces.

G. B. M.

NO. 2376, VOL. 95]

THREE BOTANICAL BOOKS.

- (1) *Mikrographie des Holzes der auf Java vorkommenden Baumarten. Vierte Lieferung.* By Dr. J. W. Moll and H. H. Janssonius. Pp. 336. (Leiden: E. J. Brill, 1914.)
- (2) *Practical Field Botany.* By A. R. Horwood. Pp. xv+193. (London: C. Griffin and Co., Ltd., 1914.) Price 5s. net.
- (3) *All About Leaves.* By the late F. G. Heath. Pp. ix+228. (London: Williams and Norgate, 1914.) Price 4s. 6d. net.

(1) **I**N this, the fourth instalment of his work on the intimate structure of the wood of Javan trees, the author deals with the families Connaraceæ, Leguminosæ, Rosaceæ, Saxifrageæ, Hamamelideæ, and Rhizophoreæ. The Leguminosæ occupy more than half the volume. In this family 118 specimens were examined, representing forty-nine species and four varieties contained in twenty-six genera. Under the heading of each family is a list of the literature in chronological order, followed by an enumeration of the species and varieties examined by the author. A general review of the gross and minute anatomy of the family as represented by the forms studied is then given, and the bearing of the results on the generally accepted sub-division of the family is discussed. These are, in the main, in conformity with the sub-division based on floral structure, but it is worthy of note that in Rosaceæ the differences between the groups are greater than is usually the case in a single family, and suggest the recognition as distinct families of the Amygdalaceæ, Chrysobalanaceæ, and Pomaceæ. A key for determining the species by means of the wood-structure is also given. Then follows a detailed description of each species or variety; first the general topography, which is sometimes illustrated by figures, and then an elaborate description of the various elements—wood-vessels, libriform fibres, wood-parenchyma, medullary rays, etc. The account includes measurements and the behaviour of the various elements to reagents. It is to be regretted that the author did not include photomicrographic reproductions of his sections; the few figures which are given are poor and show no detail.

(2) The title of Mr. Horwood's book is somewhat misleading. The book contains much useful information on the practical study of plants in the field, but also much extraneous matter often set down in a loose and desultory manner. The impression formed by the reader is that the author is a man of great industry and some knowledge, but does not realise his limitations. The book, if judiciously pruned and edited, would make a useful little volume. The author's intention is

"to explain and set forth the principles by which the ecologist should be guided, and the apparatus and plan to be adopted to enable him or her to work upon sound and approved lines." But the directions or suggestions will often lead to bewilderment; for instance, the section on pp. 4-6, entitled "What to Study," contains a curious medley of suggestions from the study of the form and size of pollen-grains to the procuring of "fruits and berries of foliage" (*sic*) for decoration at Christmas. On the other hand, the same chapter contains a useful section on flower-photography. Chapter ii., on methods of collecting, preserving, mounting, and storing plants for herbaria, contains much that is helpful, though the student will find puzzling matter in the section on "the arrangement to be adopted in the herbarium"; among other things the author suggests the preparation of "a printed list of all the species published since the year 1895 when the 'Index Kewensis' and Durand's 'Appendix' brought things up to date," thus ignoring the three supplements of the "Index Kewensis" which carry us on to the end of 1910.

A great part of chapter iii., which has the tremendous title, "The necessity for encouraging the study of botany on ecological lines, by the popularisation of pure life-histories of plants, through nature study, museums, scientific societies, and other associations, and in the university," might well have been omitted; much of it consists of extracts from the addresses or writings of well-known botanists. The next chapter, on the study of the life-history of a plant, would have been more helpful if in the brief paragraphs on the various divisions, such, for instance, those on "plants and fungi and insect-pests" or "names of wild plants" reference had been given to a good standard work on the subject. The last chapter (v.), "An outline of plant formations," is the best; it includes a brief description of various plant-formations and lists of the species which occur in them.

(3) The little book on "leaves" contains eighty photographs, mostly of British wild plants, which on the whole are good. They were specially prepared for the work, but were not seen by the author owing to his death in 1913. The text is in the style with which readers of the late Francis George Heath's botanical works are familiar. One example must suffice. Of the seed we read, "A created organism of wonderful and infinite skill confronts our marvelling sense in the remotest confines of the great vegetable world—so that we cannot begin at the beginning because we cannot comprehend the beginning! Power—unquestionable—hovers, so to speak, undiscernible in the tiny seed."

NO. 2376, VOL. 95]

OUR BOOKSHELF.

The Golden Bough. A Study in Magic and Religion. By Sir J. G. Frazer. Vol. xii. Bibliography and General Index. Pp. vii+536. (London: Macmillan and Co., Ltd., 1915.) Price 20s. net.

No book has ever been written which contains so large a mass of facts as "The Golden Bough." Nor has any book had its data more thoroughly documented. The bibliography and index, forming the twelfth and final volume of the work, fill 536 octavo pages. The index, 392 pages, is fuller than the indices to the separate volumes. Every author knows the labour of cross-references; a simple instance here is "propitiation of vermin by farmers," involving three entries. There are cases of overdoing, a good fault in an index, *e.g.* "Nat, spirit, in Burma, ii. 46." "Nat superstition in Burma, ix. 90 n¹." "Nats, spirits in Burma, iii. 90; ix. 175 sq.; propitiation of, ix. 96." Here a distinction is actually drawn between a singular and a plural. Technical generic terms in foreign languages are, like botanical and zoological terms, etc., printed in italics. But why "Oschophoria," yet "Aiora," both Greek feasts; and "Farward-dajan," yet "Sada," both Persian feasts; also "Ogboni" and "Belli-Paaro," African secret societies, yet "Ndembo" and "Hametztes," also secret societies? But these are minor inconsistencies in a monumental index.

The bibliography comprises probably six thousand books, including serial publications and dictionaries. The curious may find instructive items, *e.g.* Maletius (Maletius, Meletius, Menecius, Ian Malecki), who, by the way, wrote on the religion of the Borussians (the present-day Prussians). Many periodicals, *e.g.* *L'Année Sociologique* and *L'Anthropologie*, have not their year of institution, nor, what is far more important, their place of publication attached. How are "readers who desire to have further information," to find "*Fasciculi Malagenses, Anthropology*," or "Dinkard, a Pahlavi work"?

The distribution of anthropological research among the civilised nations may be well estimated from this bibliography. England, America, and Holland are prominent; Germany has done much, so has France. The native authorities on uncivilised peoples are an interesting addition.

A. E. CRAWLEY.

The Plateau Peoples of South America. By A. A. Adams. Pp. 134. (London: G. Routledge and Sons, Ltd., 1915.) Price 3s. 6d. net.

THE people discussed in this monograph are those inhabiting the South American plateau within the boundaries of Bolivia, Peru, and Ecuador. Bolivia, however, seems to be more closely associated with the past history of the plateau than either of the other republics. Its government is largely drawn from the plateau population, and its general culture is more clearly influenced by the plateau than that of Peru, which looks to Europe for light and guidance. The writer finds in this upland race a condition of progressive degeneration. The people who occupied the country in what may be